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【应用研究】

# 后发性白内障 Nd:YAG 激光后囊膜切开术后屈光状态及眼生物学参数的变化

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## Changes of refraction and ocular biological parameters after Nd:YAG laser capsulotomy for posterior capsule opacification

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**[Key words]** posterior capsule opacification; Nd:YAG laser capsulotomy; refraction; ocular biological parameters

**[Abstract] Objective** To evaluate the changes of refractive status and ocular biological parameters in posterior capsule opacification (PCO) patients after Nd:YAG laser capsulotomy. **Methods** Sixty-two cases (62 eyes) with PCO were recruited from June 2012 to June 2014 in Guangdong Province Hospital Of Traditional Chinese Medical. The patients were divided into two group, group A received laser capsulotomy with 4 mm diameter, and group B with 5.5 mm diameter. The best corrected visual acuity (BCVA), spherical equivalent (SE), anterior chamber depth (ACD) and axial lengths (AL) of patients were recorded before and one month after the surgery. **Results** The post-operative BCVA in two groups of patients was obviously improved compared with the pre-operation ( $Z = -4.23, -5.09$ ; both  $P = 0.000$ ). The preoperative ACD of two groups were  $(3.32 \pm 0.07)$  mm,  $(3.31 \pm 0.05)$  mm, respectively, while postoperative ACD were  $(3.45 \pm 0.07)$  mm,  $(3.48 \pm 0.07)$  mm, respectively, there were significant differences between pre-operation and post-operation in group A and B ( $Z = -4.58, -4.98$ ; both  $P = 0.000$ ). The preoperative SE in two groups were  $(-0.29 \pm 0.44)$  D,  $(-0.29 \pm 0.57)$  D, respectively, while the postoperative SE were  $(0.47 \pm 0.40)$  D,  $(0.51 \pm 0.42)$  D, respectively, there were significant differences between pre-operation and post-operation in group A and B ( $Z = -4.69, -5.03$ ; both  $P = 0.000$ ). But there was no significant difference in BCVA, SE, ACD between two groups (all  $P > 0.05$ ). There was no significant difference in AL of two groups after surgery compared with the preoperative and the comparison between the two groups (all  $P > 0.05$ ). **Conclusion** Hyperopic shift exists in PCO patients after Nd:YAG laser capsulotomy, but the change is not related with the incision size of posterior capsulotomy.

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**【关键词】** 后发性白内障;Nd:YAG 激光后囊膜切开术;屈光;眼生物学参数

**【摘要】 目的** 探讨后发性白内障行 Nd:YAG 激光后囊膜切开术后屈光状态、眼生物学参数变化特点及其与后囊膜切口大小的关系。**方法** 采用临床病例对照研究,选取 2012 年 6 月至 2014 年 6 月在广东省中医院眼科就诊的后发性白内障患者 62 例(62 眼),将入选患者分为 A 组 28 例(28 眼)、B 组 34 例(34 眼);两组患者均行 Nd:YAG 激光后囊膜切开术,A 组术中形成 4.0 mm 大小后囊膜切口,B 组术中形成 5.5 mm 大小后囊膜切口,两组患者术前、术后均行最佳矫正视力(best corrected visual acuity, BCVA)、眼压、裂隙灯、眼底检查及等效球镜(spherical equivalent, SE)、前房深度(anterior chamber depth, ACD)及眼轴长度(axial length, AL)的测量,比较 2 组各项指标。**结果** 术后两组患者 BCVA 均较术前明显提高,差异均有统计学意义( $Z = -4.23, -5.09$ , 均为  $P = 0.000$ )。两组患者术前 ACD 值分别为  $(3.32 \pm 0.07)$  mm、 $(3.31 \pm 0.05)$  mm, 术后分别为  $(3.45 \pm 0.07)$  mm、 $(3.48 \pm 0.07)$  mm, 两组术前术后比较,差异均有统计学意义( $Z = -4.58, -4.98$ , 均为  $P = 0.000$ );两组术前 SE 分别为  $(-0.29 \pm 0.44)$  D、 $(-0.29 \pm 0.57)$  D; 术后分别为  $(0.47 \pm 0.40)$  D、 $(0.51 \pm 0.42)$  D, 两组术前术后比较,差异均有统计学意义( $Z = -4.69, -5.03$ , 均为  $P = 0.000$ )。但两组之间 BCVA、ACD 及 SE 比较,差异均无统计学意义(均为  $P > 0.05$ )。AL 值两组术后与术前比较及两组间比较,差异均无统计学意义(均为  $P > 0.05$ )。**结论** 后发性白内障 Nd:YAG 激光后囊膜切开术后存在人工晶状体轻微后移,导致术后远视漂移现象,但远视漂移程度与后囊膜切口大小无关。

尽管白内障超声乳化吸出联合人工晶状体植入术已成为治疗白内障的一种普及性手术方式之一,具有术后视力恢复快、治疗效果好的优点,但是后发性

白内障(posterior capsule opacification, PCO)仍然是术后视力再次下降的主要原因之一<sup>[1]</sup>。长期以来 Nd:YAG 激光后囊膜切开术被公认为是治疗 PCO 的最佳

方法,具有疗效确切、并发症少的优点<sup>[2]</sup>。虽然已有大量文献关于 Nd:YAG 激光后囊膜切开术疗效的报道,但有关 Nd:YAG 激光后囊膜切开术后术眼的屈光状态及眼球生物学参数变化特点及该变化与后囊膜切口大小的关系的相关研究较少。本研究采用临床病例对照研究,对 62 例(62 眼)PCO 行 Nd:YAG 激光后囊膜切开术患者的术前术后屈光状态及前房深度(anterior chamber depth, ACD)、眼轴长度(axial length, AL)进行分析,并探讨该变化与后囊膜切口大小的关系,为更客观地评价 Nd:YAG 激光后囊膜切开术对屈光状态及眼生物学参数影响提供依据。

### 1 资料与方法

**1.1 一般资料** 采用临床病例对照研究。选取 2012 年 6 月至 2014 年 6 月在广东省中医院眼科就诊的 PCO 患者 62 例(62 眼),将患者分为两组,两组患者均行 Nd:YAG 激光后囊膜切开术,A 组患者术中行 4.0 mm × 4.0 mm 大小后囊膜切口,B 组患者术中行 5.5 mm × 5.5 mm 大小后囊膜切口。其中 A 组 28 例(28 眼),其中男 15 例,女 13 例,年龄 62 ~ 88 (72.8 ± 12.3)岁;B 组 34 例(34 眼),其中男 17 例,女 17 例,年龄 63 ~ 82 (71.8 ± 12.9)岁;两组患者性别、年龄、术前 BCVA 基本均衡,组间比较差异均无统计学意义(均为  $P > 0.05$ )。纳入标准:(1)所有患者患眼均在我院行白内障超声乳化吸出联合人工晶状体植入术(术中所植入人工晶状体类型均为 PM-MA 三片式人工晶状体);(2)术中人工晶状体均植入囊袋内(裂隙灯检查患眼晶状体);(3)术后人工晶状体位置正常;(4)术后裂隙灯检查发现后囊膜混浊。排除标准:(1)合并青光眼、葡萄膜炎、糖尿病视网膜病变、年龄相关性黄斑变性等眼科病史;(2)合并角膜斑翳等屈光介质混浊的患者;(3)术中人工晶状体非植入囊袋内;(4)术后人工晶状体偏心倾斜的患者。

**1.2 检查** 所有入选患者术前均进行眼科检查,包括裸眼视力、最佳矫正视力(best corrected visual acuity, BCVA)、眼压、裂隙灯检查、眼底、眼屈光检查及术眼眼生物学测量等一系列检查。采用国际标准视力表行视力检查。采用自动验光仪(日本 Topcon 公司)进行屈光检查,均测量 3 次取平均值,以等效球镜度数(spherical equivalent, SE)作为最终屈光度值记录。采用 A/B 超仪(法国光太公司)进行眼生物学参数测量,均测量 10 次取平均值,最终记录 ACD 及 AL 的测量结果,所有检查均由同一名医师完成,以减少误差。

**1.3 手术方法** 手术均由同一名医师行 Nd:YAG 激光后囊膜切开术。术前 30 min 给予复方托吡卡胺滴眼液散大瞳孔直径至 8 mm 左右,使用 Zeiss 公司的 Nd:YAG 激光机,从低能量开始,术中根据囊膜厚度随时调整能量为 1.8 ~ 2.8 mJ,平均 2.1 mJ;击发

点数:28 ~ 64 次,平均 32.0 次;总能量:59.8 ~ 246.0 mJ,平均 69.8 mJ。术中环形切开后囊膜,A 组后囊膜切开直径 4.0 mm,B 组后囊膜切开直径 5.5 mm。术后术眼常规滴双氯芬酸钠滴眼液,每天 4 次,共 3 d。

**1.4 术后随访** 术后 1 d 复查患者裸眼视力、BCVA、眼压、裂隙灯及眼底检查,并用复方托吡卡胺滴眼液将瞳孔散大至 6 ~ 8 mm,用裂隙灯照明区域直径判断后囊膜切口直径大小;术后 1 个月除了上述眼部常规检查外,采用自动验光仪行屈光检查及 A/B 超行眼生物学参数测量,最终记录 SE、ACD、AL 测量的平均值。

**1.5 统计学方法** 采用 PASW Statistics 18.0 软件包建立数据库及进行数据分析。将患者的 BCVA 转化为等到的最小角度的对数值(LogMAR)进行统计分析。对于满足正态分布方差齐性的资料组间比较采用  $t$  检验,不满足正态分布或方差不齐的资料组间比较采用秩和检验,组内手术前后比较采用配对秩和检验,计数资料采用  $\chi^2$  检验或确切概率法。检验水准为  $\alpha = 0.05$ 。

### 2 结果

**2.1 手术前后视力变化** 术前两组患者视力差异无统计学意义( $Z = -0.257, P = 0.797$ )。术后 1 个月 A 组、B 组 BCVA 与术前比较均明显提高,差异均有统计学意义( $Z = -4.23, P = 0.000; Z = -5.09, P = 0.000$ );但两组间比较,差异无统计学意义( $Z = -0.799, P = 0.424$ ,见表 1)。

表 1 两组患者 BCVA 比较

Table 1 Comparison of BCVA between two groups

Group	n	Preoperation	Postoperative 1 month	Z	P
A	28	0.69 ± 0.25	0.12 ± 0.10	-4.230	0.000
B	34	0.70 ± 0.23	0.14 ± 0.12	-5.090	0.000
Z		-0.257	-0.799		
P		0.797	0.424		

**2.2 手术前后 SE 变化** 术前两组患者 SE 差异无统计学意义( $Z = -0.301, P = 0.763$ )。术后 1 个月 A 组、B 组 SE 与术前比较均增加,差异均有统计学意义( $Z = -4.69, P = 0.000; Z = -5.03, P = 0.000$ );但两组间比较,差异无统计学意义( $Z = -0.474, P = 0.635$ ,见表 2)。

表 2 两组患者 SE 比较

Table 2 Comparison of SE between two groups

Group	n	Preoperation	Postoperative 1 month	Z	P
A	28	(-0.29 ± 0.44)D	(0.47 ± 0.40)D	-4.690	0.000
B	34	(-0.29 ± 0.57)D	(0.51 ± 0.42)D	-5.030	0.000
Z		-0.301	-0.474		
P		0.763	0.635		

**2.3 手术前后 ACD 变化** 术前两组患者 ACD 差异无统计学意义( $Z = -0.659, P = 0.510$ )。术后 1 个月 A 组、B 组患者 ACD 均较术前加深,差异有统

计学意义( $Z = -4.58, P = 0.000; Z = -4.98, P = 0.000$ );但两组间比较,差异无统计学意义( $Z = -1.544, P = 0.123$ ,见表3)。

**2.4 手术前后 AL 变化** 术前两组患者 AL 差异无统计学意义( $Z = -1.436, P = 0.151$ )。术后1个月两组患者 AL 与术前比较、两组组间比较,差异均无统计学意义( $Z = -1.362, P = 0.174; Z = -1.16, P = 0.245; Z = -0.523, P = 0.601$ ,见表4)。

表3 两组患者 ACD 比较

Table 3 Comparison of ACD between two groups

Group	n	Preoperation	Postoperative 1 month	Z	P
A	28	(3.32 ± 0.07)mm	(3.45 ± 0.07)mm	-4.580	0.000
B	34	(3.31 ± 0.05)mm	(3.48 ± 0.07)mm	-4.980	0.000
Z		-0.659	-1.544		
P		0.510	0.123		

表4 两组患者 AL 比较

Table 4 Comparison of AL between two groups

Group	n	Preoperation	Postoperative 1 month	Z	P
A	28	(22.90 ± 0.49)mm	(23.09 ± 0.54)mm	-1.360	0.174
B	34	(23.11 ± 0.63)mm	(23.02 ± 0.56)mm	-1.160	0.245
Z		-1.436	-0.523		
P		0.151	0.601		

**2.5 随访观察** 两组患者 Nd:YAG 激光后囊膜切开术后1d及1个月随访时,眼压均在正常值范围内,人工晶状体透明、位置居中,无倾斜偏心,未见虹膜睫状体炎、黄斑水肿、视网膜裂孔等并发症出现。

### 3 讨论

PCO 是由于术中残留在囊袋内的晶状体上皮细胞发生增殖、迁移、上皮-间质细胞转化、胶原沉积、晶状体纤维的再生而形成的。尽管不少术者术中运用各种手术技巧以避免术后 PCO 发生,如尽可能彻底除去晶状体上皮细胞、广泛抽吸清洗前囊、术中行晶状体前囊膜和后囊膜抛光、强力水分离技术等;同时近年来人工晶状体材料及设计也在不断地改进来预防 PCO,如丙烯酸酯和硅凝胶材料及锐利方边设计的可折叠人工晶状体临床应用<sup>[3]</sup>,但是 PCO 仍然是白内障超声乳化吸出联合人工晶状体植入术后主要并发症之一。PCO 可导致患者视力显著下降、对比敏感度下降、眩光及单眼复视<sup>[1]</sup>。据报道,白内障术后3a PCO 发病率为5.2%<sup>[4]</sup>,白内障术后5a PCO 发病率则升至11.9%。Nd:YAG 激光后囊膜切开术具有眼部反应小、疗效确切、经济方便、简单易行等多种优点,长期以来一直是 PCO 的最佳治疗方式,治疗后可使患者视力较治疗前明显提高<sup>[2]</sup>。本研究显示:A组 LogMAR 视力术前 $0.69 \pm 0.25$ ,术后 $0.12 \pm 0.10$ ,B组 LogMAR 视力术前 $0.70 \pm 0.23$ ,术后 $0.14 \pm 0.12$ ,两组患者术后 BCVA 均较术前明显提高,差异均有统计学意义(均为  $P < 0.05$ ),因此 Nd:YAG 激光后囊膜切开术可有效提高 PCO 患者视

力,结果与国内相关报道相似<sup>[5]</sup>。

尽管 Nd:YAG 激光后囊膜切开术可使 PCO 患者术后视力明显提高,但却有可能影响人工晶状体在眼内的位置,导致术后屈光状态及眼生物学参数改变。Eliacık 等<sup>[6]</sup>研究发现 Nd:YAG 激光术后 ACD 较术前增加,屈光状态呈远视漂移;Vrijman 等<sup>[7]</sup>报道 Nd:YAG 激光术后屈光状态呈远视漂移;Oztas 等<sup>[8]</sup>报道 Nd:YAG 激光术后 ACD 较术前减少,术后屈光状态呈近视漂移;国外有关 Nd:YAG 激光后囊膜切开后术眼的屈光状态及眼球生物学参数变化相关研究结果尚不统一,国内相关研究较少。通过本研究发现,PCO 患者行 Nd:YAG 激光后囊膜切开术后,A组术前 ACD 为 $(3.32 \pm 0.07)$ mm、术后为 $(3.45 \pm 0.07)$ mm,术后较术前增加;术前 SE 为 $(-0.29 \pm 0.44)$ D、术后为 $(0.47 \pm 0.40)$ D;B组术前 ACD 为 $(3.31 \pm 0.05)$ mm、术后为 $(3.48 \pm 0.07)$ mm,术后较术前增加,术前 SE 为 $(-0.29 \pm 0.57)$ D、术后为 $(0.51 \pm 0.42)$ D,由此可见两组患者术后人工晶状体位置发生后移,屈光状态均发生了远视漂移。推测其机制为 Nd:YAG 激光后囊膜切开术后,后囊膜张力减弱,后方顶推力量减弱,导致人工晶状体光学部位置后移。而人工晶状体眼屈光状态变化与术后有效晶状体位置相关(即角膜前顶点至人工晶状体的距离,相当于 A 超测量 ACD 值)<sup>[9]</sup>,因此当人工晶状体光学部位置出现后移,导致有效晶状体位置增加,人工晶状体成像焦点随之后移,故术后屈光状态呈远视漂移。

Karahan 等<sup>[10]</sup>报道 PCO 患者行 Nd:YAG 激光术,术中分别形成小于3.9mm及大于3.9mm的后囊切口时,两组对比发现,大于3.9mm组的术后人工晶状体后移更明显,术后屈光呈远视偏移更明显。本研究术后 A 组患者形成4.0mm直径大小后囊膜切口,B组患者形成5.5mm直径大小后囊膜切口,B组患者术前术后 ACD 差值及 SE 差值均较 A 组大,两组之间术后 ACD 值及 SE 差异均无统计学意义,即后囊膜切口大小与术后屈光状态无关。本研究结果与其他学者结果不统一,我们推测和本研究测量 ACD 方法及术中所植入的人工晶状体类型与其他研究不同有关。

综上所述,Nd:YAG 激光后囊膜切开术可使 PCO 患者视力明显提高,但将造成术眼人工晶状体在眼内的位置后移,术后远视漂移,远视漂移程度与后囊膜切口大小无关。但由于本研究样本量较少,随访时间相对较短,所以尚需进一步扩大样本量研究证实。

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【应用研究】

# AcrySof ReSTOR 及 Tecnis ZMB00 多焦点人工晶状体植入术后视觉质量的比较

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## Comparison of postoperative visual quality between AcrySof ReSTOR and Tecnis ZMB00 multifocal intraocular lens implantation

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**[Key words]** multifocal intraocular lens; contrast sensitivity; visual quality

**[Abstract] Objective** To compare the postoperative visual quality between AcrySof ReSTOR and Tecnis ZMB00 multifocal intraocular lens (MIOL) implantation.

**Methods** Retrospective case-control analysis of cataract phacemulsification with MIOL implantation in the second affiliated hospital of Nanchang University during January 2012 to June 2013 were carried out. Thirty-two patients (43 eyes) were divided into two groups, 17 cases (22 eyes) were implanted AcrySof ReSTOR + 4 D MIOL, 15 cases (21 eyes) were implanted Tecnis ZMB00 + 4 D MIOL. After 3 months, the far vision (5 m) were measured with the standard logarithmic visual acuity chart, the middle distance vision (66 cm) and near vision (40 cm) were measured with Colenbrander Mixed Contrast vision test card. The Takaci-CGT-1000 contrast sensitivity test instrument was used to measure the contrast sensitivity under bright, dark and glare condition, the questionnaire survey (visual interference, satisfaction and rate of taking off the glasses) were performed, the data were statistically analyzed. **Results** After 3 months, there was no statistical difference in the far vision, middle distance vision and near vision between the two groups. Under bright and bright glare state, there was no significant difference in contrast sensitivity under different spatial frequency ( $3\text{ c} \cdot \text{d}^{-1}$ ,  $6\text{ c} \cdot \text{d}^{-1}$ ,  $12\text{ c} \cdot \text{d}^{-1}$ ,  $18\text{ c} \cdot \text{d}^{-1}$ ); Under scotopic and scotopic glare state, the contrast sensitivity in the Tecnis ZMB00 group under the high spatial frequency ( $6\text{ c} \cdot \text{d}^{-1}$ ,  $12\text{ c} \cdot \text{d}^{-1}$ ,  $18\text{ c} \cdot \text{d}^{-1}$ ) were better than those in the AcrySof ReSTOR group, there were statistical differences (all  $P < 0.05$ ), but under the low spatial frequency ( $3\text{ c} \cdot \text{d}^{-1}$ ), there was no statistical difference between the two groups (all  $P > 0.05$ ). Questionnaire survey indicated that there were rare visual interference phenomenon to affect normal life after surgery in the two groups. **Conclusion** Both of AcrySof ReSTOR MIOL and Tecnis ZMB00 MIOL can provide satisfactory vision. In spite of under scotopic high spatial frequency, the contrast sensitivity of the Tecnis ZMB00 is better than that of AcrySof ReSTOR, but it does not effect the daily life for the vast majority of patients.

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**【关键词】** 多焦点人工晶状体;对比敏感度;视觉质量

**【摘要】 目的** 比较植入 AcrySof ReSTOR 及 Tecnis ZMB00 多焦点人工晶状体(multifocal intraocular lens, MIOL) 术后患者的视觉质量。**方法** 回顾性病例对照分析2012年1月至2013年6月期间在我院眼科行白内障超声乳化联合 MIOL 植入术的患者32例(43眼),根据植入的 MIOL 不同分为两组,分别为植入 AcrySof ReSTOR + 4 D MIOL 的 A 组,17例(22眼);植入 Tecnis

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